Participatory process for the EO-Based SDG co-design involving local stakeholders (v2.0)

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1	1.0	05/09/2024	First version of the deliverable for internal submission
1	2.0	14/09/2024	Internal edits approved

1 Purpose of this document

This document highlights key insights and results related to two co-design workshops implemented in the framework of UNEP WWQA 'EO pathway for SDG indicator 6.3.2' - Lake Tanganyika pilot.

2 Introduction

The UNEP WWQA EO pathway for SDG indicator 6.3.2 aims to define the pathway to SDG-ready EO data for indicator 6.3.2 reporting through a transboundary pilot in Lake Tanganyika, in East Africa. This initiative aims to contribute to innovative and cost-effective ways to improve water quality monitoring. In order to integrate diverse forms of knowledge related to the challenge, Activity 1 of the project implemented two participatory workshops to articulate a co-design process of an EO-based SDG indicator and a corresponding dashboard tool.

The following results are based on two co-design participatory workshops involving local stakeholders, practitioners, and policymakers from Lake Tanganyika. The first workshop was an online workshop held on June 26th, 2024, which included the participation of SDG 6.3.2 focal points and government representatives from Tanzania, the Democratic Republic of Congo, Burundi, and Zambia. Project consortium members from VITO, UNEP, U Stirling, 3edata, BC, and VUB participated by presenting and engaging in discussions. The second workshop took place from July 2nd to 4th, 2024, at the Lake Tanganyika Authority offices in Bujumbura. This workshop was implemented in alignment with the capacity-building activities of the Climate Adaptation Planning Through Water Monitoring in the Lakes Tanganyika and Kivu (CAPITAN-TAKI) project funded by the Flemish government, see

https://remotesensing.vito.be/news/capitan-taki-project-water-management-east-african-lakes .

Both workshops followed a similar structure. Presentations related to water quality monitoring, SDG 6.3.2 reporting, and remote sensing were presented. After each presentation, a round of questions and an open discussion facilitated by a moderator. The final part of the workshops incorporated a survey to collect participants' perceptions, preferences, and insights related to Earth observation based water quality monitoring. The structure of the survey included four sections: 1) SDG 6.3.2 reporting, 2) institutional capacities, capacity building requirements, and willingness to employ earth observation for monitoring and reporting 6.3.2, 3) requirements for water quality indicators and dashboard, and 4) dashboard functionalities for SDG 6.3.2. The survey was completed by 16 respondents. The full survey is provided in ANNEX 1.

3 Survey results

SDG 6.3.2 reporting

The majority of participants demonstrated limited knowledge of water quality monitoring coverage in their countries, with 50.4% indicating knowing that information. Additionally, 78.6% were unaware if their country reports on SDG 6.3.2. Only 16% of respondents knew who their national SDG 6.3.2 focal points were. Moreover, 78.5% of respondents were unfamiliar with the differences between Level 1 and Level 2 SDG 6.3.2 reporting. In addition, participants cited the following as the main national challenges to SDG 6.3.2 reporting: skills deficits, financial constraints, inadequate equipment, and limited internet service access.

Institutional Capacities, Capacity Building Requirements and Willingness to Employ Earth Observation for Monitoring and Reporting 6.3.2

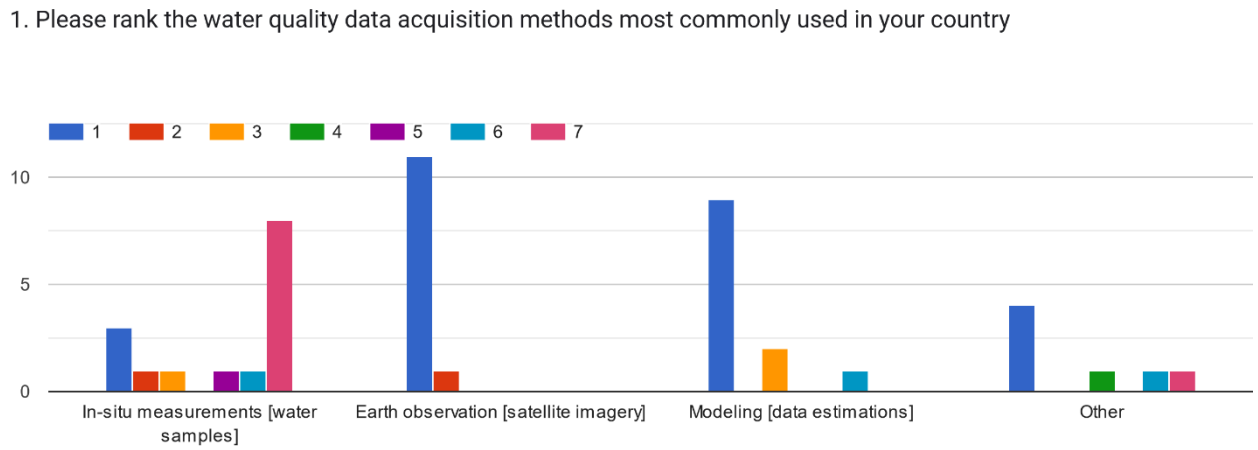

Figure 1 Water quality data acquisition

"In-situ measurements" is ranked as the most frequent method for water quality data acquisition. Regarding "Earth observation" and "Modeling" , the majority of responses ranked it as little used methods, while the "Other" category has scattered rankings.

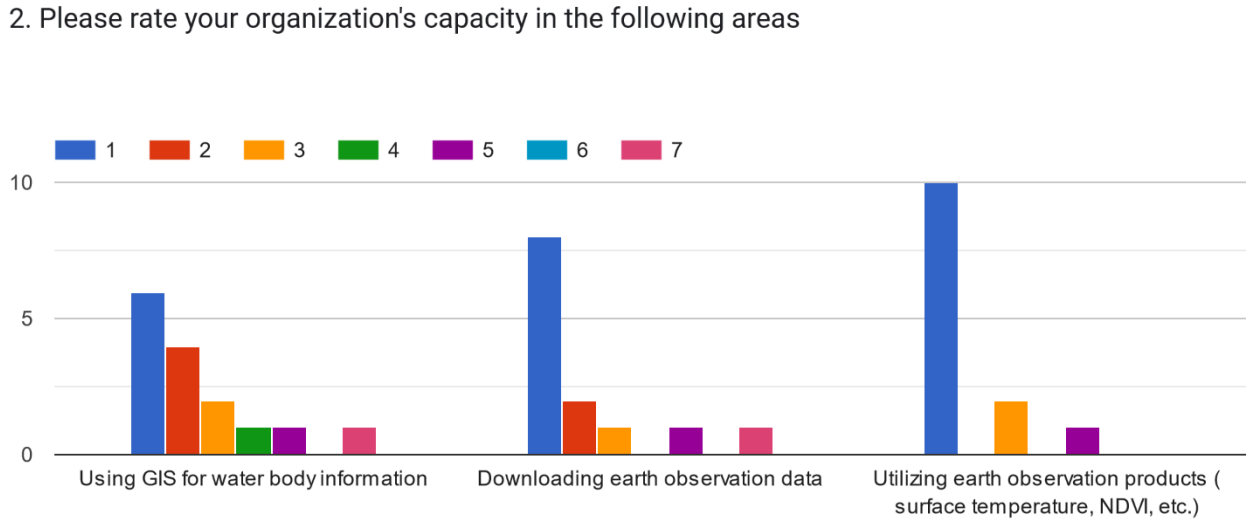

Figure 2 Institutional capacities

The results show a relatively low capacity in "Using GIS for water body information," with

a majority of respondents rating their skills at level 2, followed by level 1 (lowest ranking). In "Downloading

Earth observation data," capacity appears lower, with the majority rating at level 1, indicating moderate little capacities, while other responses are more evenly spread across lower levels. Lastly, the capacity for "Utilizing earth observation products" is predominantly rated at level 1, suggesting limited proficiency, with minimal representation at higher levels. The results indicate significant room for capacity-building in all three areas, particularly in utilizing Earth observation products and downloading Earth observation data.

Regarding the institutional willingness to incorporate Earth observation data into national water quality assessments, a significant majority (93%) of respondents expressed a high level of willingness. Some of the specific responses included:

> *“Absolutely, because Earth observation might make easy to access more data than we could with current in situ techniques”*

> *“My organization is very interested, because we need the database in order to allow the decision-makers to take decisions on preventing from water pollution and protecting human life and biodiversity and also the aquatic system”*

> *“Absolutely, because Earth observation might make easy to access more data than we could with current in situ techniques”*

About the use of Earth observation data for reporting on SDG 6.3.2, a significant majority (86%) of institutions expressed a high level of willingness to incorporate it into their reporting processes. Some of the specific responses included:

> *“Yes it will be very interesting because complete data sets will be readily available for such reporting. Currently, reporting has been difficult mostly because of inadequate data. Reporting on data will also make the institution and the country to*

contribute to global water resources management through sharing of water quality data"

"Yes, because we want to share data with others in the world"

"Yes, because it is part of the useful needs for political decision-makers for the development of the country"

Regarding institutional capacities in Earth Observation, 26% reported lacking staff with the necessary expertise, 40% indicated having staff who required further training, and 33% stated that they had staff with sufficient capabilities to effectively utilize Earth Observation technologies. Moreover, regarding the presence of other organizations with expertise in Earth observation, 90% indicated that no organizations have sufficient expertise, with some responses highlighting potential conflicts of interest. And concerning the trust on water quality indicators using Earth observation 46.7% ranked high trust, 33.4 ranked medium trust and 26.7% ranked low trust. The answers included:

"I trust EO for water quality indicators because this technique has been well tested worldwide, but we need to be trained in this new technique."

"Maybe, Earth observation might also have some limitations and challenges in achieving reliable analyses and deep critical interpretation."

"Based on good selection of water quality variables e. g I would trust it to monitor turbidity, color, chl-a, water temperature and sediments but not heavy metals, pesticides, micro-plastics, etc. However, further understanding of the EO technology would make me trust every variable that it handles"

All participants expressed interest in capacity building for Earth observation, with 100% of responses indicating a strong desire for training in this area:

"Definitely yes. I need in-person training or a taught short course in EO for water quality monitoring from a training institution."

“Personally, I need some training on topics related to satellite imagery, modelizing data either online or presential”

“yes we need online course and in-person training to deepen knowledges and more interact”

Requirements for Water Quality Indicators and Dashboard

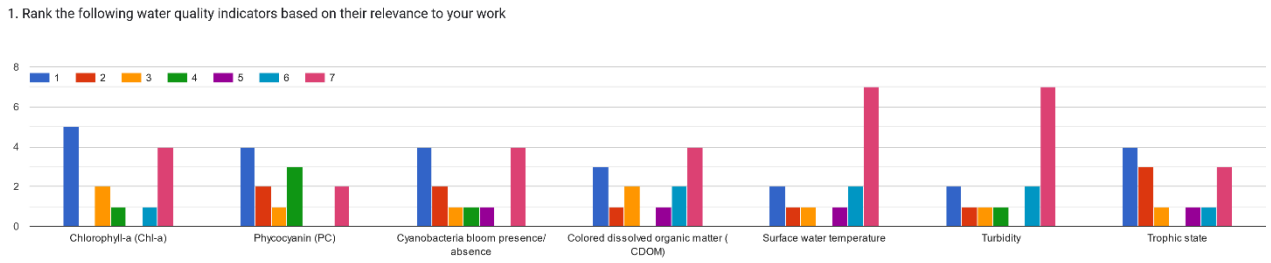

Figure 3 Water quality indicators

In relation to water quality indicators, turbidity and surface temperature are identified as the most relevant by the majority of respondents, with a significant number assigning them the highest ranking of 7 (most relevant). However, when it comes to Chlorophyll-a (Chl-a), Phycocyanin (PC), Colored Dissolved Organic Matter (CDOM), and the presence/absence of cyanobacteria blooms, the responses are more varied. While some respondents rank these indicators as highly relevant (7), others view them as less important, with a notable number assigning lower rankings (1 or 2). This disparity may be attributed to a limited understanding of different preferences on these specific water quality indicators.

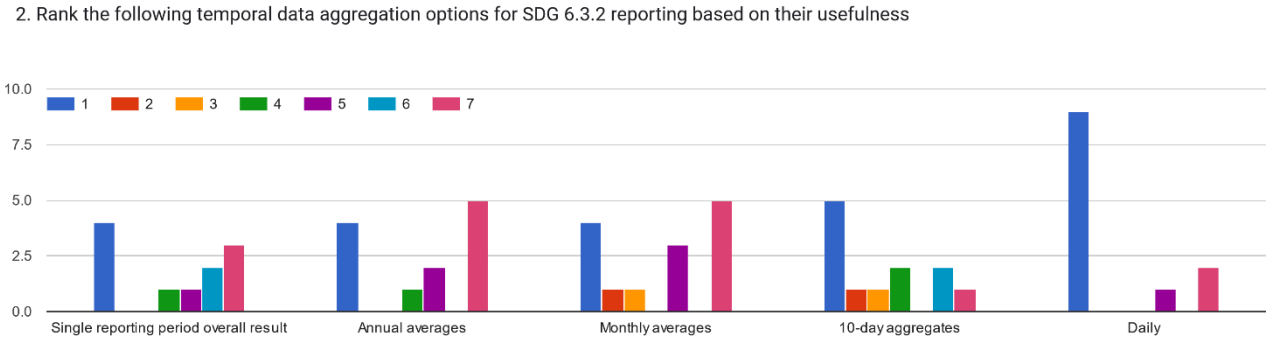

Figure 4 Aggregation options

When it comes to the overall result for a single reporting period, as well as data aggregation for annual and monthly averages, responses vary. Some respondents rank these as highly relevant (7), while others view them as less important, with a significant number assigning lower rankings (1 or 2). Additionally, the 10-day aggregate and daily data received low rankings, with the majority of responses falling in (1).

Regarding preferences for obtaining specific measurements versus identifying trends and changes, 64.3% of respondents prefer specific measurements. Additionally, 64.3% favor using an indicator with a graded scale ranging from "good" to "bad" over an indicator with a simple "Good" or "Bad" output.

Concerning the historical earth observation data on water quality, respondents referred to various periods: 2014-2024, 2000-2024, and 2010-2024. Furthermore, in terms of spatial resolution, responses varied: 1% responded 10m, 1% 1Km, 15% 100m, 15% mentioned a range between 10 to 100 m, and 68% indicated "I do not know."

Dashboard Functionalities for SDG 6.3.2

In terms of dashboard functionalities, Dashboard 1 was highly rated for usability and intuitiveness, with the majority of responses falling within the 5 to 7 range. However, responses regarding visual appeal were more varied. Concerning missing elements, 60% of respondents felt that the dashboard was complete, 20% noted a lack of diverse water quality indicators, and 20% reported challenges in understanding its functionality.

Dashboard 2 received high ratings for visual appeal and usability, with the majority of responses falling between 5 and 7. However, intuitiveness showed mixed results, with some respondents finding it highly intuitive and others rating it low. Additionally, 73% of respondents felt the dashboard was complete, 18.2% noted a lack of diverse water quality indicators, and 9.1% mentioned the need for training and financial resources to enhance the dashboard.

Dashboard 3 reflects mixed perceptions regarding visual appeal and usability, with participants rating both variables both high and low. Additionally, intuitiveness was rated below 2 by all respondents, indicating that this dashboard example is not easy to understand. Regarding missing elements, 73% of respondents felt the dashboard was complete, while 23% reported difficulties navigating through it.

Dashboard 4 reflects mixed perceptions regarding usability and intuitiveness, with participants rating both variables as either high or low. Visual appeal was ranked low by the majority of participants. Regarding missing elements, 54.6% of respondents felt the dashboard was complete, while 45.4% reported missing water quality parameters and difficulties navigating due to language issues.

Regarding the inclusion of the option to incorporate national thresholds for calculating water quality classification, 92.9% of respondents answered positively, favoring the addition of this option in the dashboard design. And in relation to the most valuable/useful features of the dashboard answers included:

> *"Water quality data visualization through maps and water quality trend analysis through graphs"*

> *"Directly map in-situ on EO data and compare values on graphs, such as time series plots."*

> *"Identification of parameters to be measured priorly, the sampling frequence, the number of analyses to be done for each parameter, the number of events to be observed in order to conclude, the regularity in collecting samples and including the target values for each sampling site."*

In terms of customizable elements, temporal aggregation and the selection of water quality variables were highly rated by the majority of participants. However, the intuitiveness of input thresholds yielded mixed results, which is inconsistent with previous analyses on this specific topic. Additionally, 100% of responses indicated an interest in

having an automated SDG 6.3.2 report.

ANNEX 1: Full survey

Stakeholder's survey

The World Water Quality Alliance (WWQA)
Earth Observation workstream presents the EO for SDG 6.3.2 project. This short-term seed project is funded by WWQA/UNEP and is a collaboration of academics, private companies and volunteers.

The survey is divided in 4 sections, please click the 'Next' button to move through them.

Your answers will be anonymus, please make sure to answer all of them

Thank you.

FIRST PART: SDG 6.3.2 Reporting

1. 1. What percentage of your country's surface water bodies are currently monitored for water quality?

2. 2. Does your country report on SDG 6.3.2 (water quality)? If yes, when was the last submission to UNEP?

3. 3. If yes to question 2, who is the designated focal point responsible for SDG 6.3.2 reporting?

4. How long has this person held this position?

5. How secure is this position (turnover rate)?

6. 4. Are you familiar with level 1 and level 2 of SDG 6.3.2 reporting?

7. 5. What are the biggest challenges your country faces in reporting on SDG 6.3.2?

SECOND PART: Institutional Capacities, Capacity Building Requirements and Willingness to Employ Earth Observation for Monitoring and Reporting 6.3.2

8. 1. Please rank the water quality data acquisition methods most commonly used in your country

1= least used and 7= most used

Mark only one oval per row.

	1	2	3	4	5	6	7
In-situ measurements [water samples]	◯	◯	◯	◯	◯	◯	◯
Earth observation [satellite imagery]	◯	◯	◯	◯	◯	◯	◯
Modeling [data estimations]	◯	◯	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯	◯	◯

9. 2. Please rate your organization's capacity in the following areas

1= least used and 7= most used

Mark only one oval per row.

	1	2	3	4	5	6	7
Using GIS for water body information	◯	◯	◯	◯	◯	◯	◯
Downloading earth observation data	◯	◯	◯	◯	◯	◯	◯
Utilizing earth observation products (surface temperature, NDVI, etc.)	◯	◯	◯	◯	◯	◯	◯

10. 3. Would your organization be interested in using earth observation for water quality monitoring for national assessments? Why or why not?

11. 4. Would your organization be interested in using earth observation data for SDG 6.3.2 reporting? Why or why not?

12. 5. Does your organization have any staff with expertise in earth observation? (Yes/No) please elaborate.

13. 6. Are you aware of other organizations in your country using earth observation for water quality monitoring? Do you collaborate with them?

14. 7. To what extent do you trust water quality indicators based on earth observation?

Mark only one oval.

1	2	3	4	5	6	7
◯	◯	◯	◯	◯	◯	◯

15. 8. Why or why not? (for your answer to question 7)

16. 9. Would you like to receive more information on earth observation?
If yes, what specific topics are of interest and how you would like to receive this information?
(Examples: online course, self-directed, in-person training, from a particular institution)

THIRD PART: Requirements for Water Quality Indicators and Dashboard

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